Increased Implant Success in Periodontally Compromised Subjects

Retrospective clinical and radiographical 5 year-evaluation of patients with and without a history of chronic periodontitis

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INTRODUCTION
Multiple studies have stated that long-term success of implant therapy may be compromised in patients with a history of periodontitis. However, implant supported fixed partial dentures provide ideal options to replace teeth that were lost due to periodontal disease.
Success of simultaneous alveolar ridge augmentation around implants is controversely discussed in the literature so far[1,2]. In a previous implant-study by Hagner et al. 2009[3] sites with simultaneous bone mineral augmentation show higher peri-implant hard tissue loss than non-augmented sites almost during the healing period.
The aim of this study is to evaluate clinical mid-term success of implants supporting fixed partial dentures in terms of remaining height of implant surrounding hard tissue [HTLoss], the quality of function according to the PISA consensus criteria[2] and wether there are differences in the outcome between patients with a history of chronic periodontitis and healthy patients.

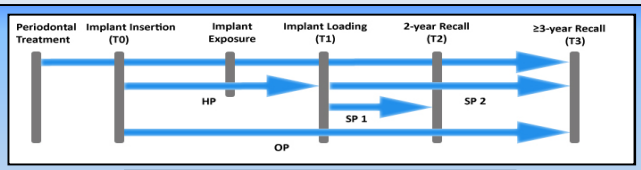

Figure 1: Time-Flow.
HP: healing period OP: observation period SP: service period (time after loading)

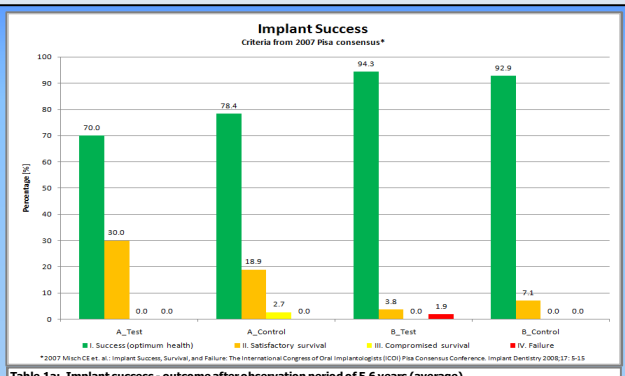

Table 1a: Implant success - outcome after observation period of 5.6 years (average)
A_Test: augmented site after CP history [CPH] B_Test: non-augmented site after CP history [CPH]
A_Control: augmented site in healthy patient B_Control: non-augmented site, healthy patient
No statistical significance *was found for different treatments in any group, no differences in outcome between implants in healthy subjects compared to CPH subjects.*

Test	Confounder adjusted	Corrected for intrapatient dependency	Effects of A	p value	
yes	no	no	0.66	0.0328	*
yes	yes	no	0.73	0.0234	*
yes	no	yes	0.87	0.0041	*
yes	yes	yes	0.83	0.0087	*
no	no	no	0.39	0.1130	
no	yes	no	0.24	0.4048	
no	no	yes	0.37	0.1580	
no	yes	yes	0.24	0.4287	

Table 1b: Effects of augmentation
A_Test: augmented site after CP history B_Test: non-augmented site after CP history
A_Control: augmented site in healthy patient B_Control: non-augmented site, healthy patient
High statistical significance *was found for different treatment groups, augmented versus non-augmented.*

MATERIAL & METHODS
148 Brånemark type implants in 74 patients inserted for submerged healing between 1999 and 2007 were evaluated. Test group patients had a history of treated chronic periodontitis [CP].
Test group: 36 CP patients (12m/25w) with 83 implants (29 with simultaneous augmentation [SA]/54 no augmentation), mean time of function was 5.6 yrs. after loading.
Control group: 38 healthy patients (12m/26w) with 65 implants (37 SA/28 no augmentation), mean time of function was 5.2 yrs. after loading.
All patients received an individual oral hygiene instruction and were integrated in a specific maintenance program.
Simultaneous alveolar ridge bone augmentation (BA) using bovine derived xenograft (BioOss® Collagen) in combination with a resorbable collagen membrane (BioGuide®) was performed in 42% of the evaluated implants.

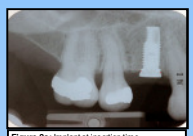
Figure 2a: Implant at insertion time.

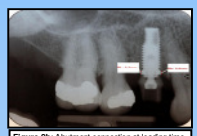
Figure 2b: Abutment connection at loading time.

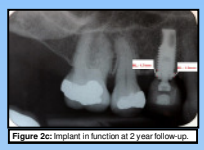
Figure 2c: Implant in function at 2 year follow-up.

Clinical and radiographical data were collected at implant insertion time (T0/Fig.2a), loading time (T1/Fig.2b), two years after loading (T2/Fig.2c) and at different times during function, at least 3 yrs. after loading and up to 9 years.
Last data collection was used for outcome evaluation (T3).
Success criteria are as described by Misch et.al., 2008 (Pisa Consensus Report)[2].
Radiographic measurements of digitized periapical x-rays were taken using Image-J Software, precision of 0.01mm.

All patients were put on a strengthened maintenance program, equal to supportive periodontal therapy following regenerative periodontal procedures:
3 months' interval of maintenance and control appointments up to 2 years after loading.
3 to 6 months' intervals upon the patients' individual risk thereafter.

Patients were subdivided in 3 compliance groups (C1= optimum compliance, C2= fair compliance, C0 = lack of compliance with the recommended maintenance regimen).

Inclusion criteria: at least 3 yrs. of function supporting fixed partial denture, non-smoker, CP history (Test)
or no history of periodontitis (Control)
Exclusion criteria: smokers, history of aggressive periodontitis, edentulous patients, incomplete radiographic follow up.

As confounders for evaluation of outcome risks were tested:
Compliance (C1, C2, C0) / bleeding on probing [BOP] / restoration-implant ratio [RIR], if >1 / age of patient / gender of patient / fixed partial denture [FPD]: crown vs. bridge / probing depth at implant [PPD], if >5mm

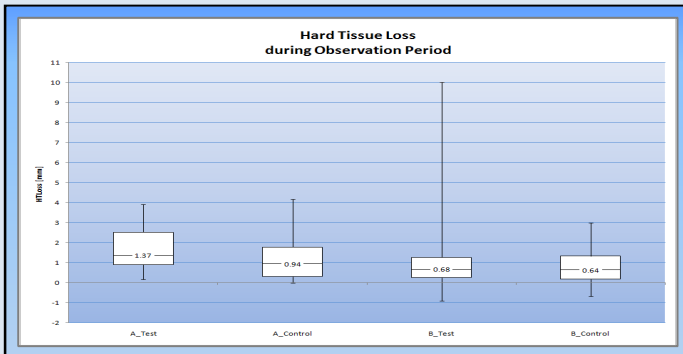

Table 2: Hard tissue loss over 5.4 yrs. (Test) / 5.6 yrs. (Control)
A_Test: augmented site after CP history B_Test: non-augmented site after CP history
A_Control: augmented site in healthy patient B_Control: non-augmented site, healthy patient
No statistical significance found for different treatments in any group, no differences in outcome between implants in healthy subjects compared to CPH subjects

RESULTS
No statistical significance between both study groups occurred (Test: CP-patients and Control: healthy patients).
There is statistical significance ($p < 0.05$) that simoultaneous augmentation using bovine bone mineral with or without membrane coverage leads to a higher amount of radiographical hard tissue loss [HTLoss] around implants compared to HTLoss of natural implant surrounding bone (1.37mm and 0.94mm vs. 0.68mm and 0.64mm).
Within the limits of the study it cannot be stated that HTLoss affects the natural implant site bone more in CP patients than in healthy patients.
There is statistical significance that implants that had to be augmented at the time of insertion show less favourable outcome after a mid-term period than non-augmented implants (augmented: 70% / 78.4% validated as „optimum success' / non-augmented: 94.3% / 92.9% validated as „optimum success').
Additional risk factors known from the literature (compliance [C1, C2, C0] / bleeding on probing [BOP] / restoration-implant ratio [RIR], if >1 / age of patient /gender of patient / fixed partial denture [FPD]: crown vs. bridge / probing depth at implant [PPD], if >5mm) have not been proven to show significant influence concerning HTLoss.

STATISTICS
Within levels of augmented (y/n) the effect of test (y/n) on mean height loss (incl. approximate p-value) is computed in four different ways:
1. by a one-way ANOVA, 2. by a linear model to account for potential confounding, 3. by one-way ANOVA including random patient interceps to account for intra-patient dependence and 4. the combination of the latter two.
The effect of augmented (y/n) as well as the effect of compliance (y/n) on mean height loss [HTLoss] are investigated analogously.

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CONCLUSION AND CLINICAL IMPLICATIONS
Within the limits of the study it has been shown that implants in periodontally compromised patients may yield long-term success comparable to implants in healthy subjects.
Simoultaneously augmented implants reveal less favourable outcome than non-augmented implants regardless CP history or periodontal health.
Confounders have not been proven to have significant impact on the results.
An intensive maintenance protocol enhances the mid-term outcome.

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